and B.F. Hansen. 2000. *Flora of Florida, Volume 1.* The University Presses of Florida, Gainesville.).

These records are significant as the only other extant populations of *Schizaea pennula* known to exist in the continental United States are in Palm Beach County at Loxahatchee National Wildlife Refuge (Gann, et. al., *Rare Plants of South Florida, Miami.* The Institute for Regional Conservation, 2002). It is significantly threatened there by the non-native invasive Old World Climbing fern (*Lygodium microphyllum* (Cav.) R. Br.). In addition, this new occurrence occupies a different plant community type from the plants at Loxahatchee, where the authors recently observed it growing in tree islands on root balls of *Osmunda cinnamomea* L. and on rotting logs.

Historically, *Schizaea pennula* was known from Miami-Dade County, Florida, where it was first discovered in 1904 by A.A. Eaton (996, GH, USF) near the headwaters of the historic Miami River. John K. Small reports an occurrence of it "over a decade later" at Royal Palm Hammock, in what is now Everglades National Park (Small, J.K. 1938: *Ferns of the Southeastern States,* The Science Press, Lancaster). One other report was made for Pinellas County, Florida, (approximately 140 km north of the Prairie Pines Preserve population) where John Beckner discovered plants in pine flatwoods (J. Beckner, Amer. Fern J 43:125, 1953). Due to habitat destruction along the Miami River, and failed surveys by the authors at Royal Palm Hammock in 2004, and others at the Pinellas County population (Darling, Thomas Jr. Amer. Fern J 51 (1):1–15, 1961), it seems unlikely that plants are present at these locations. Outside of the United States, *Schizaea pennula* is also found in the West Indies, Central America and South America (Wunderlin & Hansen 2000).

Although it is diminutive in size and easily overlooked, in the future more populations of this rare tropical fern are likely to be found.

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Confirming Dioecy in *Isoëtes butleri*.—*Isoëtes butleri*, a tufted spring ephemeral on seasonally moist alkaline soils in the central US, occurs in central Texas, south central Oklahoma, southeastern Kansas, northern and western Arkansas, southern and central Missouri, south central Kentucky, central Tennessee, northern Alabama and northwest Georgia (Lott *et al.*, 1982, Sida 9:264–266). More recently, *I. butleri* has been reported as far north as Will County in northeast Illinois (Taylor and Schwegman. 1992. Amer. Fern J. 82:82–83).

George Engelmann originally described *Isoëtes butleri* (1878. Bot. Gaz. 3:149.). In this description, Engelmann noted that George Butler, who dis-

covered the species in what is now Oklahoma, "never could find a monoecious plant; all the specimens which he found as well as those I examined, were dioecious, both sexes in about equal numbers." Engelmann again recognized the dioecious character for *I. butleri* in his monograph of North American *Isoëtes* (1882. Trans. St. Louis Acad. Sci. 4:388.). Subsequently, Pfeiffer (1922. Ann. Missouri Bot. Gard. 9:152) and Taylor *et al.* (1993. Flora North America, Vol. 2, p. 73.) did not mention this character for *I. butleri*.

Typically, *Isoëtes* species are monoecious, first developing megasporophylls early in the growing season followed by the production of microsporophylls. Therefore, in a sporiferous plant the outer sporophylls are megasporangiate and the inner ones microsporangiate. In order to confirm that *I. butleri* is dioecious, we found it would be necessary to disassemble specimens and irreparably alter herbarium voucher specimens to determine if every single sporophyll on a plant was either a megasporophyll or a microsporophyll. This was unacceptable, but the alternative of harvesting and destroying many living plants from natural sites for sampling also seemed untenable, especially by those of us who admire quillworts.

In June 2004, there was an opportunity to sample for and confirm the dioecy of northern populations of *I. butleri* that Butler and Engelmann had observed and reported long ago in southern populations. Through cooperation with the Midewin National Tallgrass Prairie, the Chicago Botanic Garden, and a private trucking company we were able to obtain a sample of fresh plants rescued from an unprotected site scheduled for bulldozing and a newly discovered population of more than 200 individuals in a public park. Most of the 156 plants rescued from the trucking company site were planted in a similar, protected habitat by Midewin staff.

Twenty, randomly selected, sporiferous plants of *I. butleri* from Will County, Illinois were sampled. Sixteen plants were collected on 15 June 2004 from a remnant dolomite prairie site slated for development along Durkee Road off Interstate Highway 55 and River Road in Channahon and four plants were collected on 19 June 2004 from a park site undergoing restoration in Lockport. By mid to late June, the sporophylls of *I. butleri* in Will County are yellow in color and beginning to shrivel in preparation for summer dormancy, indicating that their spores are largely mature, but mostly still contained within their sporangia.

A razor blade was used to cut the point of attachment along the base of each sporophyll so that the sporophyll could be easily detached intact. In this way every sporophyll was removed in centripetal order and serially placed adaxial face down on newsprint and pressed until dry. Sporophylls were mounted in order adaxial face up in clear plastic envelopes affixed to standard herbarium sheets and labeled accordingly. Voucher specimens are in the Milwaukee Public Museum Herbarium (MIL).

Each individual plant specimen was examined for its production of megasporophylls and microsporophylls. Megasporangia and microsporangia were easy to distinguish without magnification. The sporangium wall of *I. butleri* is transparent and tetrads of large, white megaspores can be discerned within megasporangia early in development. Megaspores become more obvious as

they mature. Microsporangia are evident by the uniform color imparted by the dust-sized microspores inside. Developing microspores are initially white, but microsporangia soon develop a dark, metallic gray appearance due to the color of the maturing microspores packed inside. Maturation of the sporophylls is centripetal with the most mature sporangia in sporophylls at the periphery of the leaf cluster.

All twenty of the plants sampled were either megasporophyllous or microsporophyllous. Ten plants bore only megasporangia and ten bore only microsporangia. No bisexual plants were detected. In our sample, plants averaged 39±13 (s. d.) sporophylls per individual with a range of 17 to 62 sporophylls. Female plants averaged 43±15 megasporophylls per individual and male plants averaged 35±10 microsporophylls per individual.

In the most peripheral positions around the leaf cluster of each plant, from zero to eight non-green, leaf base-like scales with arrested subula development were found. On average, about one-half of these scales bore functional sporangia. Sporangium shape sometimes used as a diagnostic character, changed states with the location of its sporophyll. The outer sporophylls contained roundish to oval shaped sporangia, whereas the more central sporophylls contained progressively more oblong to linear shaped sporangia.

Fresh, sporiferous specimens of *I. butleri* can be easily sexed by removal of their sporophylls and examination of sporangia content. Megasporangia and microsporangia are readily distinguished by the size and color of the spores inside. Sporangia shape varies from oval to linear, indicating that, at least in *I. butleri* from Will Co. Illinois, sporangium shape would not be a stable diagnostic character. Our observations confirm that *I. butleri* is dioecious in the Will County, Illinois populations sampled. Based on our sample, plants have a one to one sex ratio just as reported by Butler and Engelmann in the original description of the species. To our knowledge, no other species of *Isoëtes* has been documented as dioecious.—NICHOLAS A. TURNER and W. CARL TAYLOR, Milwaukee Public Museum, Milwaukee, WI 53233 and SUSANNE MASI and MARY E. STUPEN, Chicago Botanic Garden, Glencoe, IL 60022.